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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/019,087	02/05/1998	HIROYUKI ENOMOTO	TIJ-24816	1640

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EXAMINER

PEREZ RAMOS, VANESSA

ART UNIT PAPER NUMBER

1765

DATE MAILED: 07/23/2002

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Please find below and/or attached an Office communication concerning this application or proceeding.

AS-26

Office Action Summary	Application No.		Applicant(s)	
	09/019,087		ENOMOTO ET AL.	
	Examiner		Art Unit	
	Vanessa Perez-Ramos		1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 01 February 2002.
- 2a) ☒ This action is FINAL. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-11 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-11 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ | 6) <input type="checkbox"/> Other: _____ |

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DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsuji (U.S. 5,514,625) in view of Harari (U.S. 4,933,739).

In regard to claims 1-3, Tsuji teaches a method of manufacturing a semiconductor device comprising: forming an insulating film over a substrate (col. 5, lines 7-10), forming a first mask on said insulating film (col. 5, line 24) and forming a resist film on the first mask film (col. 5, line 18). This resist film serves as a mask during the etching process (col. 5, lines 32-35) to form an opening (col. 5, lines 29-31), which is followed by the formation of trenches on said insulating film (col. 5, lines 26-28). Furthermore, Tsuji teaches the formation of a second mask film (col. 5, line 46) and its use as an etching mask during the formation of connecting holes (col. 5, lines 44-50). Tsuji also teaches the formation of a wiring layer by burying an electroconductive material in the trenches (col. 7, lines 19-23). Furthermore, Tsuji discloses that the second mask is located in the same position where the next opening would be later etched. Given the fact that the second opening in Applicant's invention is etched through the sidewalls covered with the second

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mask film, it is the Examiner's position that Tsuji's disclosure about the position of the openings etched after deposition of the second mask read on Applicant's limitation of "the second mask film covering sidewalls and a bottom of the trenches".

Unlike the claimed invention, Tsuji does not disclose the removal of the first and second mask films, nor does he disclose the trenches having sidewalls. Furthermore, Tsuji does not disclose that the trenches are made deeper than the thickness of the insulating film, so as to penetrate into a portion of the substrate.

Harari discloses a semiconductor manufacturing process that includes the formation of a trench, wherein a trench penetrates the substrate (col. 13, lines 30-68). Harari discloses that this has many advantages, including: (1) there is no area penalty; (2) all areas of the device have equal access to the substrate ground supply; and, (3) excellent uniformity of substrate potential distribution across large chips. Furthermore, Harari explicitly discloses the fact that a trench has sidewalls (col. 24, line 30).

It is the Examiner's position that it would have been obvious to one skilled in the art at the time of the invention to modify Tsuji by etching trenches that penetrated the substrate, as per Harari, because this is a well known procedure in the art of semiconductor manufacturing, and furthermore, because of the many advantages disclosed by Harari, all of which are desirable features in circuits. Furthermore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Tsuji by removing the first and second mask films during the semiconductor manufacturing process, since it is well known in the art of

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semiconductor manufacturing that masks are meant to be removed after etching and other processes. Furthermore, although Tsuji does not explicitly disclose that his trenches have sidewalls, it is well known to any skilled in the art that a trench has sidewalls, as it has sides and the “walls” that form its sides are its sidewalls. Evidence can be found by referring to any one of Tsuji’s Fig. 4-8, where it can be noted that the trench formed has sidewalls. Furthermore, Harari explicitly discloses the fact that a trench has sidewalls (col. 24, line 30). Therefore, and as stated above, even though Tsuji does not explicitly disclose that his trenches have sidewalls, this is an inherent property of a trench, as evidenced by Harari.

In regard to claims 4, 7 and 9, these claims differ from Tsuji by specifying various materials for the insulating film. It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Tsuji by using different materials to form the insulating film in anticipation of an expected result, since the use of such different materials is well known in the art of semiconductor manufacturing.

In regard to claims 5-6, 8 and 10-11, these claims differ from Tsuji by specifying that the holes are in contact with the lower electrodes in the capacitors of the memory cells, and by disclosing that capacitors are set for storing information. It is the Examiner’s position that these are conditions well known in the semiconductor art, and that it would have been obvious to modify Tsuji by disclosing the above-mentioned information.

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Response to Arguments

3. Applicant's arguments filed 2/1/02 have been fully considered but they are not persuasive.

In response to Applicant's argument that the first and second mask films of Tsuji are not equivalent to Applicant's first and second mask films, it is the Examiner's position that the masks in Tsuji are located and are performing the same function as the masks in Applicant's claimed invention, and, therefore, read on Applicant's claims. Tsuji's first mask film is located over an insulating film, which is located over a substrate, just as Applicant's first mask is. Tsuji discloses the subsequent formation of a second mask, as does Applicant. In both processes, openings are formed through the layers, and these openings result in the formation of trenches. The Examiner stands by her earlier position that Tsuji's teachings read on Applicant's claimed invention.

Applicant argues that "although the trenches shown in Tsuji are shown as having sharply vertical sidewalls...the walls are actually tapered", wherein the present invention can 'eliminate or dramatically reduce" such tapering. It is noted that no evidence has been presented to support Applicant's opinion regarding the verticality (or lack of) of Tsuji's sidewalls..

In response to Applicant's argument that Harari does not disclose the utilization of first and second mask film as an etching mask in etching trenches, it is noted that the Examiner only relied on the teachings of Harari as a secondary reference, to show that it is a well known procedure in the art of semiconductor manufacturing to have trenches deep enough so as to penetrate the substrates.

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4. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Vanessa Perez-Ramos whose telephone number is (703) 306-5510.

VPR

July 17, 2002


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